

THE INVENTION CLAIMED IS

1. A stretchable electronic apparatus, the apparatus having a central longitudinal axis and the apparatus being stretchable in a longitudinal direction generally aligned with the central longitudinal axis, comprising:

    a stretchable polymer body, and

    at least one circuit line operatively connected to said stretchable polymer body, said at least one circuit line extending in the longitudinal direction and having

    a longitudinal component that extends in the longitudinal direction and having

    an offset component that is at an angle to the longitudinal direction, said longitudinal component and said offset component allowing the apparatus to stretch in the longitudinal direction while maintaining the integrity of said at least one circuit line.

2. The stretchable electronic apparatus of claim 1 wherein said longitudinal component that extends in the longitudinal direction and said offset component that is at an angle to the longitudinal direction comprise a 2-D serpentine circuit producing a spring in said at least one circuit line.

3. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line has a circuit line longitudinal axis that extends generally parallel to the central longitudinal axis of the electronic apparatus and wherein said longitudinal component that extends in the longitudinal direction and said offset component that is at an angle to the longitudinal direction extend laterally from said circuit line longitudinal axis.

4. The stretchable electronic apparatus of claim 1 wherein said longitudinal component that extends in the longitudinal direction and said

offset component that is at an angle to the longitudinal direction comprise a 3-D corduroy circuit producing stress relieves structures in said at least one circuit line.

5. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line has a circuit line longitudinal axis that extends generally parallel to the central longitudinal axis of the electronic apparatus and wherein said longitudinal component that extends in the longitudinal direction and said offset component that is at an angle to the longitudinal direction extend in a vertical direction above and below said circuit line longitudinal axis.

6. The stretchable electronic apparatus of claim 1 wherein said stretchable polymer body is silicone.

7. The stretchable electronic apparatus of claim 1 wherein said stretchable polymer body comprises poly(dimethylsiloxane).

8. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line comprises a conductive micron-scale wire.

9. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line comprises a conductive metal paste.

10. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line comprises a photolytic metal material.

11. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line comprises a conductive polymer.

12. The stretchable electronic apparatus of claim 1 wherein said stretchable polymer body comprises a microcable.

13. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line has a circuit line longitudinal axis that extends generally parallel to the central longitudinal axis of the electronic apparatus and wherein said

longitudinal component that extends in the longitudinal direction and said offset component that is at an angle to the longitudinal direction extend both laterally from said circuit line longitudinal axis and vertically above and below said circuit line longitudinal axis.

14. The stretchable electronic apparatus of claim 1 wherein said at least one circuit line has a circuit line longitudinal axis that extends generally parallel to the central longitudinal axis of the electronic apparatus, said circuit line having a first section with a longitudinal component that extends in the longitudinal direction and an offset component that is at an angle to the longitudinal direction and extends laterally from said circuit line longitudinal axis, and a second section with a longitudinal component that extends in the longitudinal direction and an offset component that is at an angle to the longitudinal direction and extends vertically above and below said circuit line longitudinal axis.

15. A method of producing a stretchable electronic apparatus having a central longitudinal axis and being stretchable in a longitudinal direction generally aligned with the central longitudinal axis, comprising the steps of:

providing a stretchable polymer body;  
applying to said stretchable polymer body, a circuit line longitudinal component that extends in the longitudinal direction, and  
applying to said stretchable polymer body, a circuit line offset component that is at an angle to the longitudinal direction,  
said longitudinal component and said offset component allowing the apparatus to stretch in the longitudinal direction while maintaining the integrity of said circuit line longitudinal component and said circuit line offset component.

16. The method of claim 15 wherein said stretchable polymer body is silicone.

17. The method of claim 15 wherein said stretchable polymer body comprises poly(dimethylsiloxane).

18. The method of claim 15 wherein said steps of applying to said stretchable polymer body a circuit line longitudinal component that extends in the longitudinal direction and applying to said stretchable polymer body, a circuit line offset component that is at an angle to the longitudinal direction are applied extending laterally from the central longitudinal axis.

19. The method of claim 15 wherein said steps of applying to said stretchable polymer body a circuit line longitudinal component that extends in the longitudinal direction and applying to said stretchable polymer body, a circuit line offset component that is at an angle to the longitudinal direction are applied extending vertically from the central longitudinal axis.

20. The method of claim 15 wherein said steps of applying to said stretchable polymer body a circuit line longitudinal component that extends in the longitudinal direction and applying to said stretchable polymer body, a circuit line offset component that is at an angle to the longitudinal direction are applied extending laterally and vertically from the central longitudinal axis.

21. The method of claim 15 wherein said step of applying to said stretchable polymer body a circuit line offset component that is at an angle to the longitudinal direction is applied extending laterally and vertically from the central longitudinal axis.

22. The method of claim 15 including the steps of applying to said stretchable polymer body a circuit line longitudinal component that extends in the longitudinal direction and applying to said stretchable polymer body, a

circuit line offset component that is at an angle to the longitudinal direction are applied extending laterally from the central longitudinal axis, and applying to said stretchable polymer body a circuit line longitudinal component that extends in the longitudinal direction and applying to said stretchable polymer body, a circuit line offset component that is at an angle to the longitudinal direction are applied extending vertically from the central longitudinal axis.